3. REVIEW OF SOURCE APPORTIONMENT ANALYSES

This section describes the day-of-the-week variations in source contributions based on prior receptor modeling analysis performed by Desert Research Institute for the South Coast Air Basin (Fujita et al. 1997). The analysis includes 252 canister samples that were collected by Desert Research Institute during the summer of 1995 for the California Air Resources Board study of the air quality impacts of California Phase 2 reformulated gasoline (Zielinska et al., 1999). DRI collected samples for speciated hydrocarbons and carbonyl compounds twice a day (7-10 a.m. and 2-5 p.m. PDT) at downtown Los Angeles, Burbank and Azusa for six seven-day periods (July 8-14 and 17-23, August 1-7, August 31 - September 6, September 9-15 and 24-30) (252 samples). Emission source composition profiles were derived from several sources of data. Gasoline composition data include sixty samples from the Los Angeles area that were collected during the summer of 1995 and analyzed at the University of California, Riverside College of Engineering – Center for Environmental Research and Technology (CE-CERT). The headspace vapors for a subset of these gasoline samples were analyzed by DRI. Vehicle exhaust profiles were derived from DRI's measurements from the Sherman Way and Sepulveda Tunnels in Los Angeles (Gertler et al. 1997). Fujita et al. (1997) describes the Chemical Mass Balance (CMB) receptor model and approach used to perform the hydrocarbon source apportionment, and the sampling and analysis methods used to obtain the source and ambient hydrocarbon composition data.

3.1 Weekday Variations in Hydrocarbon Source Apportionment

Source contributions are estimated for gasoline exhaust, diesel exhaust, gasoline evaporative loss (both motor vehicle and refueling), excess ethane and propane, composite surface coatings, and unidentified. Table 3-1 lists the source contribution estimates by day of the week for Azusa, Burbank and Los Angeles–N. Main. The same data are shown as line plots in Figures 3-1, 3-2, and 3-3 for Azusa, Burbank, and Los Angeles–N. Main, respectively. The average day-of-the-week variations in source contribution estimates (ug/m^3) show substantial reductions in the contribution of light-duty exhaust during weekend mornings. The weekend effect is particularly noticeable at downtown Los Angeles where the average light-duty exhaust contributions on Sunday mornings are half (in ug/m^3) of the corresponding contributions on an average weekday morning. In comparison, the average light duty exhaust contributions on Sunday afternoons are about 80 percent (in ug/m^3) of the corresponding contributions on an average weekday afternoon.

The ratios of the NMHC source contributions on Sunday and Saturday to an average of the five weekdays are shown in Table 3-2. For the three-site average, the contributions of gasoline vehicle exhaust on Sunday range from 70 to 80 percent of the average weekday contribution with the lowest ratios on Sunday mornings. The corresponding ratios for diesel exhaust are considerably more variable than gasoline vehicle exhaust. The lowest weekend to weekday ratio for diesel occurs on Sunday afternoon (0.55). Although diesel exhaust has a relatively small effect on the weekday–weekend differences in NMHC, it has a much larger effect on weekday–weekend differences in NOx emissions because the ratio of NOx to NHMC emissions of diesel vehicles are substantially higher than that of gasoline vehicles. Gasoline evaporative emissions, ethane and propane, and unidentified NMHC have no significant day-of-

the-week variation. Coating emissions on the weekends are much lower compared to weekdays on a fractional basis. However, their absolute contributions are relatively low from the CMB analysis.

STI and DRI are currently under contract with the South Coast Air Quality Management District (SCAQMD) to analyze the data collected at Photochemical Assessment Monitoring Stations (PAMS) in the SoCAB during the summers of 1994-97. As part of this work, DRI will apply the Chemical Mass Balance (CMB) receptor model to the PAMS speciated hydrocarbon database. The report is currently in progress.

The results of the CMB analysis are based upon a limited number of samples. However, the results are consistent with the day-of-the-week variations shown in Section 2 for CO concentrations in the basin. Results indicate that diesel vehicles may be significant contributors to the large weekday-weekend changes in NO concentrations. While gasoline vehicle emissions are much lower on Sunday during the morning hours, the CMB results indicate that diesel vehicle emissions are lower during the afternoon as well. Lower NO emissions from diesel vehicles during these periods will contribute to higher VOC/NOx ratios during Sunday afternoons.

Table 3-1
VOC Source Contribution Estimates (mg/m^3) by Site and Day of the Week

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Azusa 6-9 a.m. (PDT)							
Gasoline Exh	164.7	189.6	179.7	147.2	190.2	188.2	159.4
Diesel Exh	37.3	51.4	51.6	48.2	75.2	48.8	42.7
Gasoline Evap	65.1	91.6	69.1	56.7	66.3	69.2	61.7
Ethane, Propane	41.7	62.0	52.6	46.0	59.5	57.5	41.6
Coatings	6.4	8.4	13.4	9.4	22.4	15.7	12.8
Unidentified	29.6	28.0	23.1	28.0	35.0	24.8	25.4
Azusa 1-4 p.m. (PDT)							
Gasoline Exh	78.6	85.8	80.3	75.5	102.8	109.9	85.3
Diesel Exh	18.9	34.8	33.5	39.9	41.5	40.8	20.5
Gasoline Evap	46.9	44.2	33.3	44.8	54.9	50.0	40.5
Ethane, Propane	22.5	27.7	27.2	32.8	35.9	44.3	25.8
Coatings	0.3	9.9	5.2	5.2	10.2	10.5	2.3
Unidentified	20.0	26.0	25.9	23.4	20.7	24.2	23.4
Burbank 6-9 a.m. (PDT)							
Gasoline Exh	197.3	265.4	285.8	250.7	289.8	287.6	199.4
Diesel Exh	46.1	56.5	61.8	53.8	66.1	66.0	44.0
Gasoline Evap	87.3	97.0	90.0	84.1	88.5	94.3	91.6
Ethane, Propane	57.4	60.3	69.6	59.8	64.9	76.3	48.5
Coatings	10.5	18.5	17.4	32.8	17.5	31.9	9.8
Unidentified	20.9	35.2	37.8	17.4	25.6	17.0	24.6
Burbank 1-4 p.m. (PDT)							
Gasoline Exh	67.4	98.5	97.5	100.7	117.6	116.7	80.4
Diesel Exh	17.8	20.6	28.2	28.8	34.8	24.3	24.0
Gasoline Evap	40.2	39.6	45.3	36.9	56.8	42.6	53.5
Ethane, Propane	40.9	31.4	30.8	32.2	37.1	47.2	35.7
Coatings	7.8	8.7	23.6	23.1	9.0	9.0	4.5
Unidentified	26.6	27.7	16.5	20.3	24.0	24.9	20.8
Los Angeles - N. Main 6-9 a.m. (PDT)							
Gasoline Exh	138.8	258.3	257.0	222.5	264.4	306.8	216.7
Diesel Exh	70.0	50.8	52.0	47.0	55.9	66.0	54.5
Gasoline Evap	69.0	60.9	52.7	49.9	50.5	73.1	66.6
Ethane, Propane	56.6	63.5	53.7	49.2	53.3	72.7	46.6
Coatings	5.5	15.1	13.9	9.0	12.4	15.4	9.4
Unidentified	35.5	23.3	25.0	22.6	33.8	40.0	26.0
Los Angeles - N. Main 1-4 p.m. (PDT)							
Gasoline Exh	83.1	109.4	95.5	92.3	109.0	111.3	77.7
Diesel Exh	17.9	29.8	34.1	40.5	38.1	33.0	28.1
Gasoline Evap	40.1	46.0	46.3	59.6	50.2	51.6	51.9
Ethane, Propane	32.3	37.5	26.0	31.6	29.2	29.0	32.3
Coatings	1.5	4.0	6.0	7.2	5.1	3.0	2.9
Unidentified	20.6	36.4	23.2	34.8	33.5	30.7	24.5

Table 3-2
Ratio of NMHC Source Contributions on Sunday and Saturday to Average Weekday

	6-9 a.m. (PDT)		1-4 p.m. (PDT)	
	Sun	Sat	Sun	Sat
Azusa				
Gasoline Exh	0.92	0.89	0.87	0.94
Diesel Exh	0.68	0.78	0.50	0.54
Gasoline Evap	0.92	0.87	1.03	0.89
Ethane, Propane	0.75	0.75	0.67	0.77
Coatings	0.46	0.93	0.03	0.28
Unidentified	1.07	0.91	0.83	0.97
Burbank				
Gasoline Exh	0.72	0.72	0.63	0.76
Diesel Exh	0.76	0.72	0.65	0.88
Gasoline Evap	0.96	1.01	0.91	1.21
Ethane, Propane	0.87	0.73	1.14	1.00
Coatings	0.44	0.41	0.53	0.31
Unidentified	0.78	0.92	1.17	0.92
Los Angeles - N. Main				
Gasoline Exh	0.53	0.83	0.80	0.75
Diesel Exh	1.29	1.00	0.51	0.80
Gasoline Evap	1.20	1.16	0.79	1.02
Ethane, Propane	0.97	0.80	1.05	1.05
Coatings	0.42	0.72	0.29	0.58
Unidentified	1.23	0.90	0.65	0.77
Average				
Gasoline Exh	0.72	0.81	0.77	0.82
Diesel Exh	0.91	0.83	0.55	0.74
Gasoline Evap	1.03	1.01	0.91	1.04
Ethane, Propane	0.86	0.76	0.96	0.94
Coatings	0.44	0.69	0.28	0.39
Unidentified	1.03	0.91	0.88	0.89

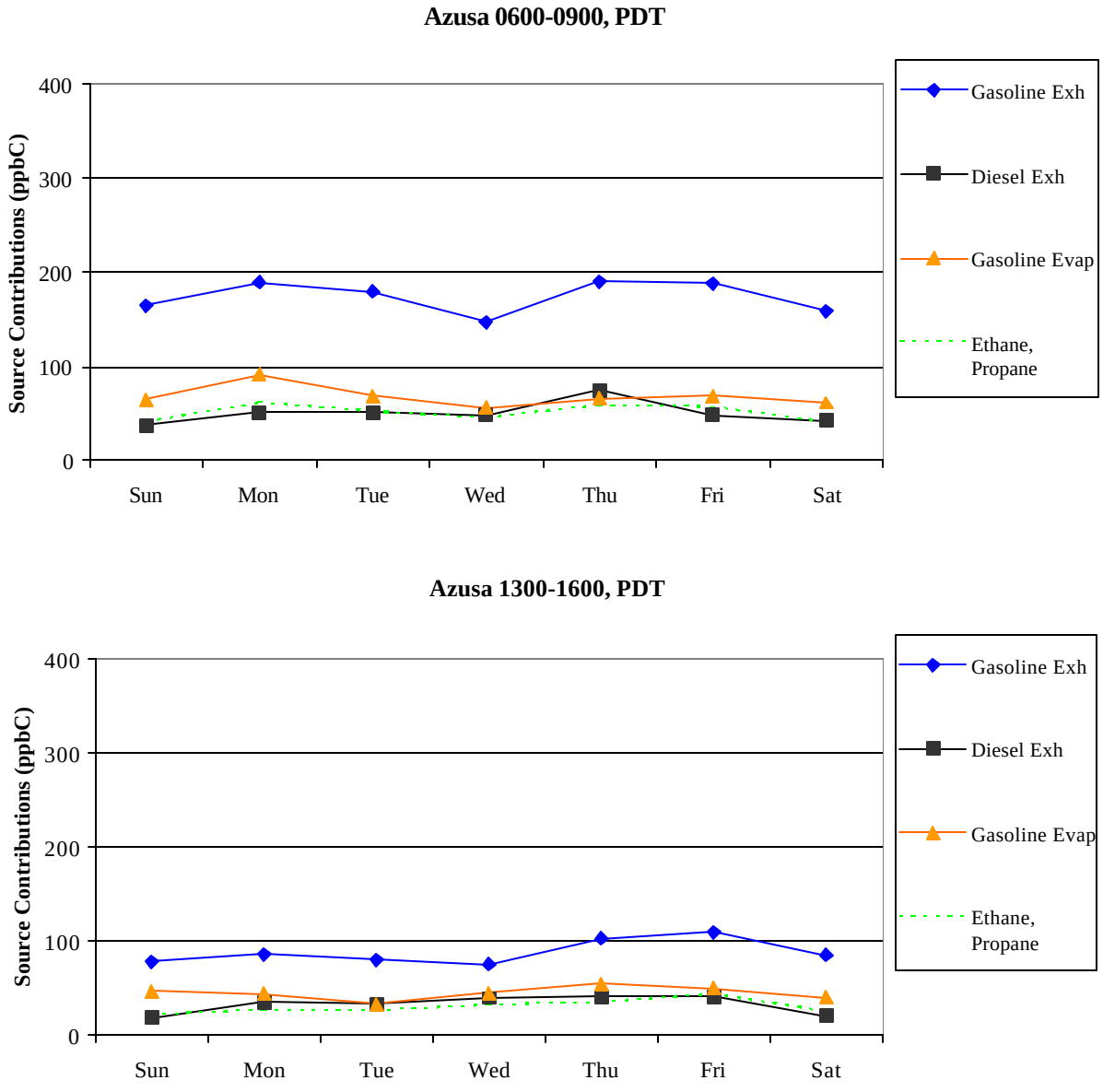

Figure 3-1. Day-of-the-week variations in source contribution estimates to ambient VOC at Azusa during summer 1995.

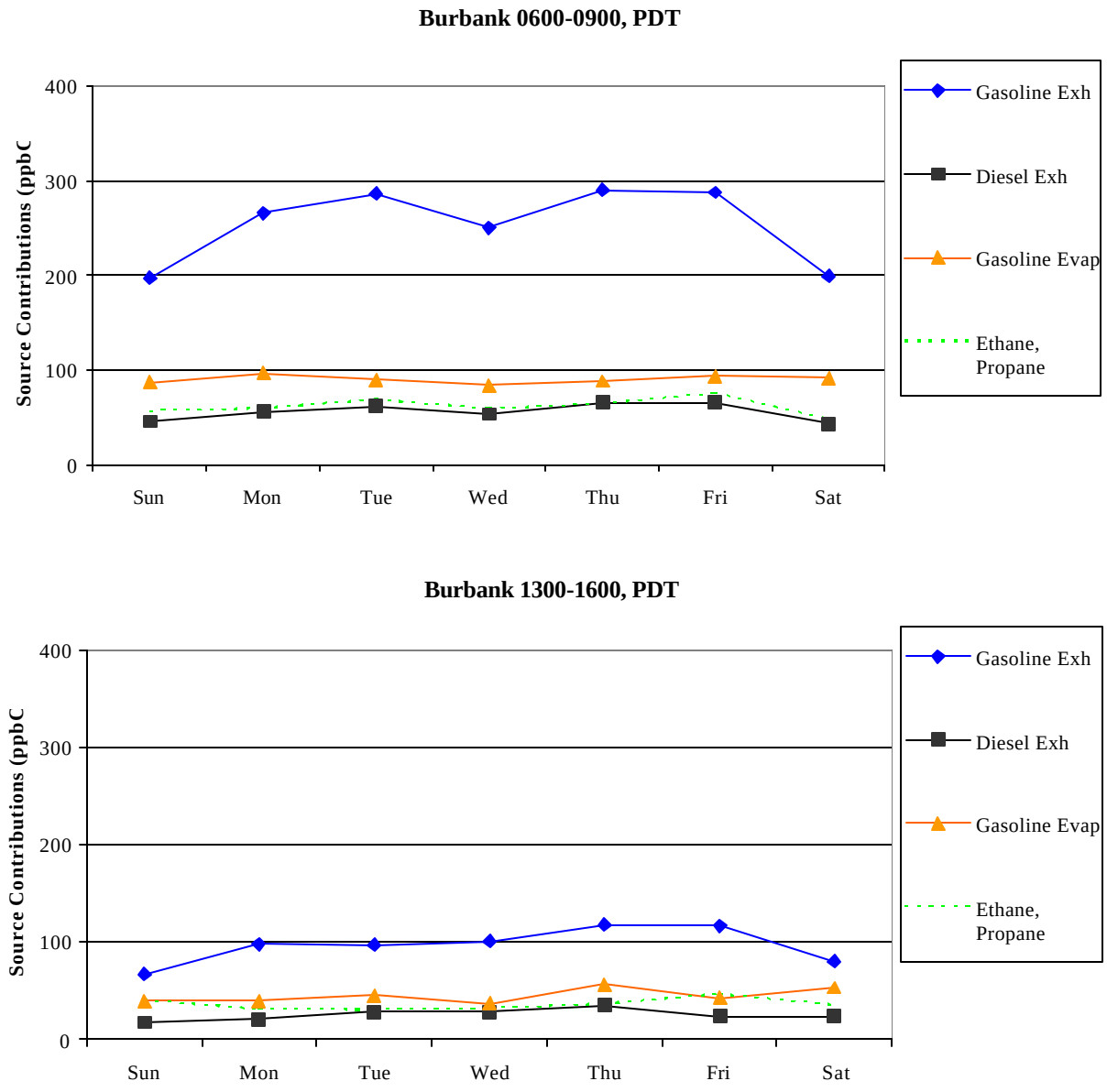

Figure 3-2. Day-of-the-week variations in source contribution estimates to ambient VOC at Burbank during summer 1995.

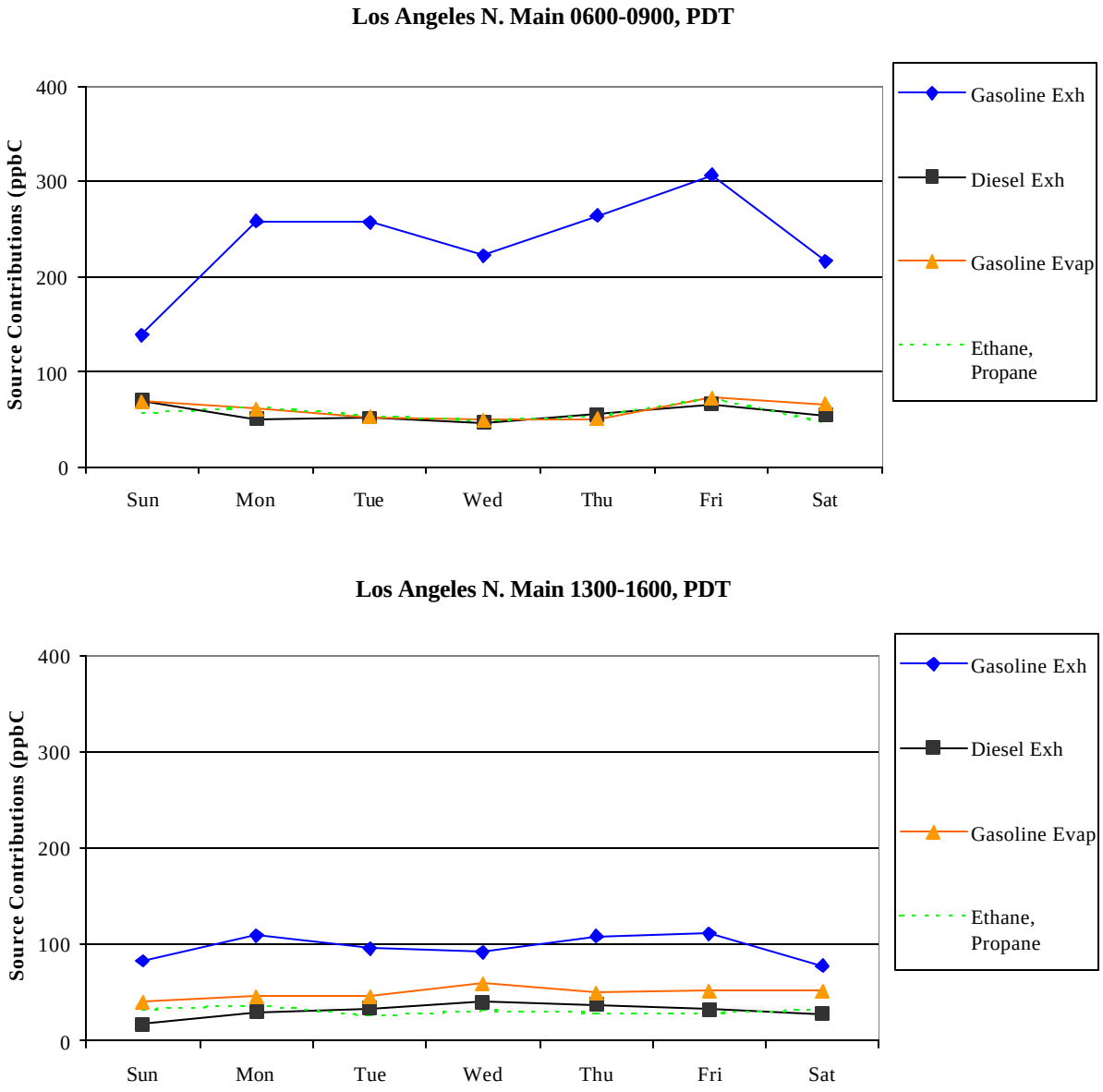

Figure 3-3. Day-of-the-week variations in source contribution estimates to ambient VOC at Los Angeles – N. Main during summer 1995.